Contaminant Screening Study & Remedial Investigation Soil QA/QC Sample PLM Trend Analysis Report (Revision 0)

for

Libby Asbestos Site, Operable Unit 4

February 2005

Contract No. DTRS57-99-D-00017
Task Order No. 29

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Acronyms

CDM	CDM Federal Programs Corporation
CSS	contaminant screening study
CSF	close support facility
EPA	U.S. Environmental Protection Agency
LA	Libby amphibole
PLM	polarized light microscopy
PLM-9002	polarized light microscopy 9002 method
PLM-Grav	polarized light microscopy gravimetric method
PLM-VE	polarized light microscopy visual area estimation method
QA/QC	quality assurance/quality control
RI	remedial investigation
SOP	standard operating procedure
SRC	Syracuse Research Corporation
%	percent

Section 1
Introduction

Libby, Montana is a community located near an open pit vermiculite mine which began limited operation in the 1920's and was operated on a larger scale by W.R. Grace Company from 1963 to 1990. Vermiculite from this mine contains varying amounts of amphibole asbestos, which when inhaled poses a threat to human health.

The U.S. Environmental Protection Agency (EPA) has been conducting investigations and clean-up of Libby amphibole (LA) asbestos containing materials in Libby since 1999. Historical investigations at the Libby Asbestos Site include the Phase I (2000), Phase II (2001), contaminant screening study (CSS) (2002) and remedial investigation (RI) (ongoing) sampling programs.

1.1 Objective

The objective of this report is to present a review of the Libby investigation quality assurance/quality control (QA/QC) data for soil sampling. Specifically, the review will evaluate the soil QA/QC samples collected in conjunction with the CSS and RI field programs between 2002 and 2004, and analyzed by polarized light microscopy (PLM). Based on the trends presented in this report, quality control samples collected during other phases of work (e.g., pre-design inspections, removal activities) may be evaluated and included in a subsequent version or overall project trend analysis report.

Section 2
Program Review

2.1 Contaminant Screening Study Field Program

The CSS was initiated in May 2002 with the goal of categorizing every property within the Libby study boundary as either remediation required, no remediation required, or additional information needed to determine remediation requirements in accordance with EPA's May 2002 action memorandum amendment (EPA 2002).

In order to accomplish this goal, the CSS investigation used a combination of visual inspections, verbal interviews, and soil sampling to screen each property in the study area for the presence or absence of potential sources of LA. Screening and sampling efforts focused on areas of the property where vermiculite products were most likely to be encountered (e.g., attic insulation and garden soil) and where the potential disturbance and exposure to LA-containing vermiculite was most likely (e.g., near-surface soils).

A QA/QC program was developed for the CSS to ensure that the quality of the data collected in the field could be assessed (CDM 2002). In addition to general quality assurance practices such as proper training (e.g., reconnaissance and field team orientation) and information verification procedures (e.g., field form completion checks, supplemental verification of vermiculite, screening field checks, and field audits) a series of QA/QC field samples were collected as part of the CSS. These included field splits, field duplicates, field equipment blanks, and rinsate samples. Rinsate samples are aqueous samples collected during the CSS in 2002. These samples are not discussed in this report because they fall outside the scope of soil samples analyzed by PLM.

2.1.1 Field Split Samples

Field split samples are splits of a single sample that serve to evaluate the precision of both the field sampling and the laboratory's sample preparation and analysis. In the field one sample is collected from a series of subsamples (up to 5) and placed into a stainless steel mixing bowl. The sample is homogenized and then equal parts are placed into two separate containers. One sample is labeled as the parent sample and the other sample the split. The two samples are sent to the laboratory blindly, ensuring that the laboratory is unaware of the relationship between the two. The required collection frequency for field splits is 1 per 20 soil samples (5 percent [%]).

Originally, the term field splits was not part of the CSS QA/QC program. Samples collected using the procedures described above were referred to as field duplicates. However, following an EPA audit in August 2002, a change was made to the procedure for collecting field duplicates. This new procedure was implemented on September 16, 2002 and is described in the next section. Due to this change in collection procedures, samples collected prior to September 16, 2002 are now referred to as field splits; samples collected on or after September 16, 2002 are referred to as field duplicates. A copy of the modification directing this change can be found in Appendix A.

2.1.2 Field Duplicate Samples

Field duplicate samples are co-located soil samples that serve to evaluate the variability of sample results within a given use area. A parent sample is collected from up to five subsamples in a given land use area. The duplicate of this sample is collected from the same number (i.e., five) of randomly located subsamples in the same land use area. These samples are collected independent of the parent sample with separate sampling equipment. The required collection frequency for field duplicates is 1 per 20 soil samples (5 %).

2.1.3 Field Equipment Blanks

Field equipment blanks are collected to determine if decontamination procedures of field equipment are adequate to prevent cross-contamination of samples during sample collection.

Field equipment blanks are collected by placing asbestos-free silica sand in a decontaminated mixing bowl that had been used that day to homogenize samples. The silica sand is mixed in the bowl using decontaminated sample collection equipment (e.g., hand trowel) that had been used that day to collect samples. The silica sand is then submitted as a sample for analysis. The required collection frequency for field equipment blanks is one sample collected at the end of each day and by a different field team each day of the sampling week. The sample coordinator and/or field team leader is responsible each day for assigning a team to collect the field equipment blank.

2.2 Remedial Investigation Field Program

The RI field program conducted in 2003 and 2004 was designed to supplement the 2002 CSS. The goals of the program were to:

1. Complete CSS investigations at properties within the study area that were not visited in 2002

2. Collect additional information at a subset of properties visited in 2002 to determine if remediation was required at those properties (CDM 2003a)

The RI investigation used the same screening tools implemented during the CSS (e.g., visual inspections, verbal interviews, and soil sampling) with the addition of dust sampling to screen each property for the presence or absence of potential sources of LA.

The QA/QC program developed for the RI was similar to the CSS QA/QC program. Once again the RI program included proper training (e.g., reconnaissance and field team orientation), information verification procedures (e.g., field form completion checks, supplemental verification of vermiculite, screening field checks, and field audits), and an assortment of QA/QC field samples. The RI QA/QC samples included field duplicates, field equipment blanks, dust field blanks and dust lot blanks. Discussion regarding dust QA/QC samples is not in included in this report, because they fall outside the scope of soil samples analyzed by PLM.

2.2.1 Field Duplicate Samples

Field duplicate samples collected for the RI program were collected using the same protocol (i.e., procedures, frequency, and rationale) as field duplicate samples collected during the CSS program (see Section 2.1).

2.2.2 Field Equipment Blanks

Field equipment blanks collected for the RI program were collected using the same protocol (i.e., procedures, frequency, and rationale) as field equipment blanks collected during the CSS program (see Section 2.1). However, the rate changed from one per day to one per week.

2.3 Close Support Facility Sample Processing Program

All soil samples collected as part of the CSS and RI field programs were shipped to CDM's close support facility (CSF) in Denver, Colorado for sample processing prior to being sent for asbestos analysis. The majority CSS and RI sample processing occurred between April 2003 and August 2004.

The original guidance document for soil sample processing was the CSF Soil Sample Preparation Plan (CDM 2003b). In it, was the standard operating procedure for (SOP) soil sample preparation, ISSI-LIBBY-01 (Revision 6) (Syracuse Research Corporation [SRC] 2002). This version of the SOP contained two initial QA/QC samples; preparation blanks and preparation duplicates. Later revisions to this SOP that had additional soil sample processing QA/QC samples were incorporated as they became available. Incorporation of these changes is discussed below.

2.3.1 Preparation Blank Samples

Preparation blank samples are prepared to determine if cross-contamination is occurring during sample processing (i.e., drying, sieving, grinding, and splitting). The preparation blank consists of asbestos free quartz sand. One preparation blank is processed with each batch of field samples. A batch of samples is defined as a group of samples that have been prepared together for analysis at the same time (approximately 125).

Preparation blanks were phased out in April 2003 and replaced by drying blanks and grinding blanks. A preparation blank, by definition, was intended to be processed with each batch of field samples. Since samples rarely went through the entire sample processing routine together (i.e., drying, sieving, grinding, and splitting), the definition of this QC sample needed to be changed. To this extent, drying blanks and grinding blanks were created.

2.3.2 Drying Blank Samples

The first drying blank was created on July 7, 2003. Drying blank samples are prepared to determine if cross-contamination is occurring during sample drying. The drying blank consists of approximately 100 to 200 grams of asbestos free quartz sand. One drying blank is processed with each drying batch of field samples. A drying batch of samples is a group of samples that have been dried together.

2.3.3 Grinding Blank Samples

The first grinding blank was created on April 9, 2003.Grinding blank samples are prepared to determine if decontamination procedures of laboratory equipment used to prepare asbestos samples are adequate to prevent cross-contamination of samples during sample grinding and splitting. A grinding blank consists of asbestos free quartz sand and will be processed once per day, on days that field samples are ground.

2.3.4 Preparation Duplicate Samples

Preparation duplicate samples are splits of samples submitted for sample preparation after drying but prior to sieving. These samples serve to evaluate the precision of both the sample preparation process and the laboratory analysis. The material for the preparation duplicate is obtained by using the Jones splitter to divide the preparation sample into two equal sub-parts. One preparation duplicate sample will be processed for every 20 field samples prepared.

2.4 Analytical Program

Multiple existing analytical methods have been modified to analyze samples collected at the Libby site in order to quantify the site-specific contaminant of concern, LA. In addition to samples analyzed by National Institute for Occupational Safety and Health's (NIOSH) Method 9002 (PLM-9002), this report includes samples analyzed by two additional PLM methods: PLM visual area estimation (PLM-VE) method SRC-Libby-03-Rev 0 (Syracuse Research Corporation [SRC] 2003b), and PLM gravimetric (PLM-Grav) method SRC-Libby-01-Rev 1 (SRC 2003c). The soil QA/QC samples associated with these analyses are laboratory duplicates and inter-laboratory analysis samples.

2.4.1 Laboratory Duplicate Samples

Laboratory duplicate samples are the comparison of one microscope preparation slide to a second microscope preparation slide that comes from the same sample. This second analysis is performed by second analyst. These samples serve to evaluate the precision of the laboratory analysis. One laboratory duplicate is created for every 10 samples.

2.4.2 Inter-Laboratory Analysis Samples

Inter-laboratory analysis samples were not a pre-determined group of QA/QC samples for the analytical program. Instead, this type of sample is defined as a single sample that has been analyzed by more than one laboratory using the same analysis method. These samples were identified through a query of the Libby 2 database using the criteria mentioned above.

2.4.3 Soil Sample Binning

Following quantification of LA in soils using the analytical methods above, Libby samples are binned by the laboratory according to the following:

Bin A: nondetect
Bin B: less than 1% (this bin associated with PLM-9002 and PLM-Grav only)
Bin B1: trace (less than 0.2%)
Bin B2: between 0.2 and 1%
Bin C: 1% or greater

Bin B is associated with the PLM-9002 and PLM-Grav method only. However, for the purposes of data comparison in this report PLM-9002 and PLM-Grav data that was reported by the laboratories as Bin B was manually stratified into either Bin B1 or Bin B2 using EPA accepted protocol. This stratification protocol is presented in Appendix B. The binning classification is used in Section 3 of this report to evaluate trends in field split, field duplicate, preparation duplicate, and laboratory duplicate data.

Section 3
Results Summary

This section presents a summary of all of the soil QA/QC samples as part of the Libby CSS and RI activities between 2002 and 2004 and analyzed by any of the three PLM methods (PLM-9002, PLM-Grav, or PLM-VE). Table 3-1 presents these QA/QC samples and summarizes the frequency collection requirements.

In order to evaluate parent versus split/duplicate data, concordance between parent sample bin and the split/duplicate bin was measured. Sample pairs are considered concordant if the analytical laboratory classified the samples in the same bin (e.g., A and A); the samples are weakly discordant if the laboratory classified the samples one bin apart from each other (e.g., A and B1); and the samples are strongly discordant if the laboratory classified the samples more than one bin apart from each other (e.g., A and C). This evaluation strategy was applied to field split samples (Table 3-2), field duplicate samples (Table 3-3), preparation duplicate samples (Table 3-4), laboratory duplicate samples (Table 3-5), and inter-laboratory analysis samples (Table 3-6).

The reader should note that the number of samples collected does not equal the number of analysis (Table 3-1). This is a result of samples being analyzes multiple times, either by the same method or different methods. The primary example of this occurring is a samples being split into a fine fraction (which is analyzed by PLM-VE) and a course fraction (which is analyzed by PLM-Grav). Thus, one sample has two analyses. Furthermore, the number of analysis presented in Table 3-1 does not equal the number of comparison counts in the concordance tables. In reviewing the data, there were two explanations for this difference. The number of concordance comparison counts may exceed the number of analyses because the either the parent or QC sample was analyzed more than once, creating more than one comparison. In addition, the number of analyses may exceed the number of concordance comparison counts because the parent sample does not match one or more of the following attributes: CharacteristicID, ResultMineralClass, AnalyticalMethod. Thus, a comparison could not be made between the parent and QC sample.

3.1 Field QA/QC Samples

3.1.1 Field Splits

Table 3-2 presents, for each of the three soil analytical methods, the degree of concordance (i.e., concordant, weakly discordant, or strongly discordant) between the field and split samples. From the table, the following is observed:

- Samples analyzed by PLM-9002: 16 of 17 total field sample/split sample pairs were concordant (94%), while one pair was weakly discordant (6%). No sample pairs were strongly discordant.

- Samples analyzed by PLM-Grav: 158 of 161 total sample pairs were concordant (98%), 2 were weakly discordant (1%), and one was strongly discordant (<1%).

- Samples analyzed by PLM-VE: 283 of 309 total sample pairs were concordant (92%), 25 were weakly discordant (8%), and 1 pair was strongly discordant (<1%).

In addition, the actual collection rate (5.4%) exceeded the expected collection rate (5.0%).

3.1.2 Field Duplicates

Field duplicate data was also evaluated using concordance between the field sample bin and duplicate sample bin. From Table 3-3, the following is observed:

- Samples analyzed by PLM-9002: 2 of 3 total field sample/duplicate sample pairs were concordant (67%), one pair was weakly discordant (33%), and no sample pairs were strongly discordant.

- Samples analyzed by PLM-Grav: 195 of 198 total sample pairs were concordant (98%), 3 were weakly discordant (2%), and no pairs were strongly discordant.

- Samples analyzed by PLM-VE: 341 of 376 sample pairs were concordant (91%), 34 were weakly discordant (9%), and 1 pair was strongly discordant.

In addition, the actual collection rate (5.7%) exceeded the expected collection rate (5.0%).

3.1.3 Field Equipment Blanks

One hundred and ninety five (195) field equipment blanks were collected during the CSS and RI field programs between 2002 and 2004 (Table 3-1). Multiple analyses were conducted on those samples including 20 PLM-9002, 2 PLM-GRAV, and 197 PLM-VE. All analyses, except 1 PLM-VE, were non-detect for LA (Bin A). The one outstanding result contained trace amounts of LA (Bin B1). In addition, the actual collection rate (1.66 equipment blanks per week) exceeded the expected collection rate (1 equipment blank per week).

3.2 Close Support Facility QA/QC Samples

3.2.1 Preparation Blanks

Thirty three (33) preparation blanks were collected during CSF operations between 2002 and 2004 (Table 3-1). Multiple analyses were conducted on those samples including 10 PLM-9002, and 27 PLM-VE. All analysis were non-detect for LA (Bin A). In addition, the actual collection rate (1.1 preparation blank per batch) exceeded the expected collection rate (1 preparation blank per batch).

3.2.2 Dry Blanks

Two hundred sixty four (264) dry blanks were collected during CSF operations between 2002 and 2004 (Table 3-1). Multiple analyses were conducted on those samples including 270 PLM-VE. All analyses, except 1, were non-detect for LA (Bin A). The one outstanding result contained trace amounts of LA (Bin B1). In addition, the actual collection rate (1.1 dry blank per batch) exceeded the expected collection rate (1 dry blank per batch).

3.2.3 Grinding Blanks

Five hundred sixty six (566) grinding blanks were collected during CSF operations between 2002 and 2004. Multiple analyses were conducted on those samples including 578 PLM-VE. All analysis, except 2, were non-detect for LA (Bin A). The two outstanding results both contained trace amounts of LA (Bin B1). In addition, the actual collection rate (0.9 grinding blanks per grinder per day) was slightly below the expected collection rate (1 grinding blank per grinder per day).

3.2.4 Preparation Duplicates

Preparation duplicate data was also evaluated using concordance between the field sample bin and duplicate sample bin. From Table 3-4, the following is observed:

- Samples analyzed by PLM-9002: 6 of 6 total sample pairs were concordant (100%). No sample pairs were discordant.

- Samples analyzed by PLM-Grav: 355 of 362 total sample pairs were concordant (98%), 7 were weakly discordant (2%), and no pairs were strongly discordant.

- Samples analyzed by PLM-VE: 674 of 732 total sample pairs were concordant (92%), 53 were weakly discordant (7%), and 5 were strongly discordant (1%).

In addition, the actual collection rate (5.5%) exceeded the expected collection rate (5.0%).

3.3 Analytical QA/QC Samples

3.3.1 Laboratory Duplicate Samples

Table 3-5 presents concordance between laboratory samples and laboratory duplicate samples. Based on the table, the following is observed:

- Samples analyzed by PLM-9002: No laboratory duplicate samples were analyzed by PLM-9002.

- Samples analyzed by PLM-Grav: 5 of 5 total sample pairs were concordant (100%). No pairs were discordant.

- Samples analyzed by PLM-VE: 1574 of 1599 total sample pairs were concordant (98%); 17 pairs were weakly discordant (1%); and 8 pairs were strongly discordant (<1%).

In addition, the actual collection rate (XX%) XXX the expected collection rate (10.0%).

3.3.2 Inter-Laboratory Analysis Samples

Table 3-6 presents concordance between samples analyzed by two different laboratories using the same analysis method. Based on the table, the following is observed:

- Samples analyzed by PLM-9002: No Inter-laboratory samples were analyzed by PLM-9002.
- Samples analyzed by PLM-Grav: No Inter-laboratory samples were analyzed by PLM-Grav.
- Samples analyzed by PLM-VE: 53 of 89 total sample pairs were concordant (60%); 31 pairs were weakly discordant (35%); and 5 pairs were strongly discordant (6%).

Because this was not a planned exercise, there were no established collection rates.

Section 4
Conclusions

This section presents a trend analysis of all of the QA/QC data for field, preparation, and laboratory quality control soil samples collected as part of the Libby CSS and RI activities between 2002 and 2004. To evaluate these trends, data is grouped into blank QA/QC samples, duplicate QA/QC samples, and Inter-laboratory samples.

4.1 Blank QA/QC Samples

Four types of blank samples (field equipment blank [field], preparation blank [CSF], dry blank [CSF], and grind blank [CSF]) were evaluated in this report. Combined there was a total 1058 samples and 1104 analysis (30 PLM-9002, 2 PLM-GRAV, and 1072 PLM-VE). Only 4 of the 1104 analysis (0.4%) had detectable levels of LA. One equipment blank had trace levels of LA (Bin B1), one dry blank had trace levels of LA (Bin B1), and two grind blanks had trace levels of LA (Bin B1). In addition, three of the four blank QA/QC samples had collection frequencies greater than expected. Grind blanks were the only blank QA/QC sample collected a frequency below expected (0.9 vs. 1 grind blanks per grinder per day).

These results indicate that field and CSF decontamination procedures were adequate in preventing cross-contamination of samples during sample collection and sample processing.

4.2 Duplicate QA/QC Samples

Four types of duplicate samples (field splits [field], field duplicates [field], preparation duplicates [CSF], and laboratory duplicates [analytical laboratory]) were evaluated in this report. Table 3-7 presents a combination of all duplicate sample comparisons, stratified by analysis. A total of 26 sample pairs were analyzed by PLM-9002. Of those 24 were concordant (92%) and 2 were weakly discordant (8%). A total of 726 sample pairs were analyzed by PLM-GRAV. Of those 713 were concordant (98%), 12 were weakly discordant (2%), and 1 was strongly discordant (<1%). A total of 3,016 sample pairs were analyzed by PLM-VE. Of those 2,872 were concordant (95%), 129 were weakly discordant (4%), and 15 were strongly discordant (<1%). In addition, all duplicate QA/QC samples had collection frequencies greater than expected.

These results demonstrate:

- The vast majority of parent and split/duplicate samples were concordant
- This high level of concordance is independent of sample type (i.e., field split, field duplicate, preparation duplicate, or laboratory duplicate)
- This high level of concordance is independent of analysis method (i.e., PLM-9002, PLM-GRAV, or PLM-VE)

- Field split samples had a high level of concordance for all analysis method, which demonstrated a high level of precision of both the field sampling and the laboratory's sample preparation and analysis

- Field duplicate samples had a high level of concordance for all analysis methods, which indicates a low level of variability between sample results within a given use area

- Preparation duplicates had a high level of concordance for all analysis methods, indicating a high level of precision of both the sample preparation process and the laboratory analysis

4.3 Inter-laboratory Samples

Inter-laboratory samples were identified through a query of the Libby2 database. This query pulled samples that had been analyzed by more than one laboratory by the same analysis method. Since this was an unplanned activity, it is difficult to provide any conclusions. The following observations were made from this data:

- This query identified 89 samples that met those criteria.

- The results (60% concordant, 35% weakly discordant, and 5% strongly discordant) showed the lowest level of concordance of any sample type in this report.

- Weakly discordant comparison had 15 (48%) pairs that were discordant between A and B1 bins, 11 (36%) pairs that were discordant between B1 and B2 bins, and 5 (16%) pairs that were discordant between B2 and C bins.

Section 5
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Tables

Table 3-1. CSS & RI Program QA/QC - Statistical Summary 1/1/2002 through 12/31/2004.

QC Category	QA/QC Sample	Collection Rate Expected	Collection Rate Actual	No. of Samples Collected	No. of Analyses			BIN			
					PLM-9002	PLM-Grav	PLM-VE	BIN	PLM-9002	PLM-Grav	PLM-VE
Field	Field Split	1 per 20 (5%)	5.4%	327	19	183	314	A	18	181	284
								B1	1	2	28
								B2	-	-	2
								C	-	-	-
	Field Duplicate	1 per 20 (5%)	5.7%	359	4	233	366	A	3	228	332
								B1	1	4	29
								B2	-	-	5
								C	-	1	-
	Equipment Blank	1 per day - CSS 1 per week - RI	1.7 per week	195	20	2	197	A	20	2	196
								B1	-	-	1
								B2	-	-	-
								C	-	-	-
Close Support Facility	Prep Blank	1 per batch (samples)	1.1 per batch	33	10	0	27	A	10	-	27
								B1	-	-	-
								B2	-	-	-
								C	-	-	-
	Dry Blank	1 per batch (oven)		264	0	0	270	A	-	-	269
								B1	-	-	1
								B2	-	-	-
								C	-	-	-
	Grind Blank	1 per day	0.9 per day	566	0	0	578	A	-	-	576
								B1	-	-	2
								B2	-	-	-
								C	-	-	-
	Prep Duplicate	1 per 20 (5%)	5.6%	729	12	414	730	A	10	409	673
								B1	1	5	47
								B2	1	-	7
								C	-	-	3
Analytical Laboratory	Lab Duplicates	10%	X%	1552	0	8	1568	A	-	8	1441
								B1	-	-	113
								B2	-	-	9
								C	-	-	5
	Inter-Lab Study	n/a	n/a	89	0	0	178	A	-	-	100
								B1	-	-	42
								B2	-	-	25
								C	-	-	11

n/a - not applicable

Table 3-2. Field Split Concordance Tables Stratified by Analysis

PLM-9002	Expected Bin	Field Sample			
		A	B1	B2	C
Field Split	A	16			
	B1	1			
	B2				
	C				

Category	Comparison Counts	%
concordant	16	94%
weakly discordant	1	6%
[redacted]	0	0%

PLM-GRAV	Expected Bin	Field Sample			
		A	B1	B2	C
Field Split	A	157	1	[redacted]	
	B1	1	1		
	B2				
	C				

Category	Comparison Counts	%
concordant	158	98%
weakly discordant	2	1%
[redacted]	1	< 1%

PLM-VE	Expected Bin	Field Sample			
		A	B1	B2	C
Field Split	A	267	12		
	B1	13	15		
	B2	[redacted]		1	
	C				

Category	Comparison Counts	%
concordant	283	92%
weakly discordant	25	8%
[redacted]	1	< 1%

Table 3-3. Field Duplicate Concordance Tables Stratified by Analysis

PLM-9002	Expected Bin	Field Sample			
		A	B1	B2	C
Field Duplicate	A	2			
	B1	1			
	B2				
	C				

Category	Comparison Counts	%
concordant	2	67%
weakly discordant	1	33%
[redacted]	0	0%

PLM-GRAV	Expected Bin	Field Sample			
		A	B1	B2	C
Field Duplicate	A	193			
	B1	3	1		
	B2				
	C				1

Category	Comparison Counts	%
concordant	195	98%
weakly discordant	3	2%
[redacted]	0	0%

PLM-VE	Expected Bin	Field Sample			
		A	B1	B2	C
Field Duplicate	A	325	15		
	B1	16	12		
	B2	[redacted]	3	4	
	C				

Category	Comparison Counts	%
concordant	341	91%
weakly discordant	34	9%
[redacted]	1	<1%

Table 3-4. Preparation Duplicate Concordance Tables Stratified by Analysis

PLM-9002	Expected Bin	Field Sample			
		A	B1	B2	C
Prep Duplicate	A	5			
	B1				
	B2			1	
	C				

Category	Comparison Counts	%
concordant	6	100%
weakly discordant	0	0%
[redacted]	0	0%

PLM-GRAV	Expected Bin	Field Sample			
		A	B1	B2	C
Prep Duplicate	A	355	2		
	B1	5			
	B2				
	C				

Category	Comparison Counts	%
concordant	355	98%
weakly discordant	7	2%
[redacted]	0	0%

PLM-VE	Expected Bin	Field Sample			
		A	B1	B2	C
Prep Duplicate	A	640	29	[redacted]	
	B1	23	28		
	B2	[redacted]	1	3	
	C		[redacted]		3

Category	Comparison Counts	%
concordant	674	92%
weakly discordant	53	7%
[redacted]	5	1%

Table 3-5. Laboratory Duplicate Concordance Tables Stratified by Analysis

PLM-9002	Expected Bin	Field Sample			
		A	B1	B2	C
Lab Duplicate	A				
	B1				
	B2				
	C				

Category	Comparison Counts	%
concordant	0	0%
weakly discordant	0	0%
[redacted]	0	0%

PLM-GRAV	Expected Bin	Sample			
		A	B1	B2	C
Lab Duplicate	A	5			
	B1				
	B2				
	C				

Category	Comparison Counts	%
concordant	5	100%
weakly discordant	0	0%
[redacted]	0	0%

PLM-VE	Expected Bin	Sample			
		A	B1	B2	C
Lab Duplicate	A	1452	13	[redacted]	
	B1	2	108	2	
	B2			9	
	C				5

Category	Comparison Counts	%
concordant	1574	98%
weakly discordant	17	1%
[redacted]	8	<1%

Table 3-6. Interlaboratory Concordance Tables Stratified by Analysis

PLM-9002	Expected Bin	Lab A			
		A	B1	B2	C
Lab B	A				
	B1				
	B2				
	C				

Category	Comparison Counts	%
concordant	0	n/a
weakly discordant	0	n/a
strongly discordant	0	n/a

PLM-GRAV	Expected Bin	Lab A			
		A	B1	B2	C
Lab B	A				
	B1				
	B2				
	C				

Category	Comparison Counts	%
concordant	0	n/a
weakly discordant	0	n/a
strongly discordant	0	n/a

PLM-VE	Expected Bin	Lab A			
		A	B1	B2	C
Lab B	A	41	15	[redacted]	
	B1		7	11	[redacted]
	B2			3	5
	C				2

Category	Comparison Counts	%
concordant	53	60%
weakly discordant	31	35%
[redacted]	5	5%

Table 3-7. Combined Duplicate QA/QC Sample Concordance Tables Stratified by Analysis

PLM-9002	Expected Bin	Field Sample			
		A	B1	B2	C
Duplicate	A	23	0	0	0
	B1	2	0	0	0
	B2	0	0	1	0
	C	0	0	0	0

Category	Comparison Counts	%
concordant	24	92%
weakly discordant	2	8%
[redacted]	0	0%

PLM-GRAV	Expected Bin	Field Sample			
		A	B1	B2	C
Duplicate	A	710	3	[redacted]	0
	B1	9	2	0	0
	B2	0	0	0	0
	C	0	0	0	1

Category	Comparison Counts	%
concordant	713	98%
weakly discordant	12	2%
[redacted]	1	<1%

PLM-VE	Expected Bin	Field Sample			
		A	B1	B2	C
Duplicate	A	2684	69	[redacted]	0
	B1	54	163	2	0
	B2	[redacted]	4	17	0
	C	0	[redacted]	0	8

Category	Comparison Counts	%
concordant	2872	95%
weakly discordant	129	4%
[redacted]	15	<1%

Appendix A
CSS Modification Number 000057 – Duplicate Sample Collection

000057

Record of Deviation/ Request for Modification
to the
Libby Sampling and Quality Assurance Project Plan
Field Activities

Instructions to Requester: Fax to contacts at bottom of form for review and approval. File approved copy with Data Manager and fax copy to SRC.

Project QAPP (circle one): PE Study Part a (approved 6/00), b (approval pending), c (approval pending)
Phase I (approved 4/00) Phase II (approved 2/01)
Removal Action (approved 7/00) CSS (approval 5/02)

Scenario No. (circle one): 1 2 3 4 NA

Requester: Dee Warren Title: CSS Task Leader
Company: CDM Date: 9-13-02

Description of Deviation:
Duplicate Sample collection.

Field Logbook and page number deviation is documented on: 100091 pg. 76-77
Reason for Deviation:
Sample collection procedure changed (see attached letter to Jim Christiansen)

Potential Implications of this Deviation:
None

Duration of Deviation (circle one):
Temporary Date(s):
Resident address(es):

Permanent (complete Proposed Modification Section)

Proposed Modification to SQAPP (attach additional sheets if necessary; state section and page numbers of SQAPP when applicable):
Field duplicate sample collection procedure added to Soil Sample Collection SOP CDM-LIBBY-05

Technical Review: [signature] Date: 9/13/02
(Volpe Project Manager or designate)

Quality Assurance Review and Approval: [signature] Date: 9/13/02
(Quality Assurance Coordinator or designate)

Approved By: Jim Christiansen Title: 9/17/02 Date: 9/17/02
(USEPA OSC or SSC)

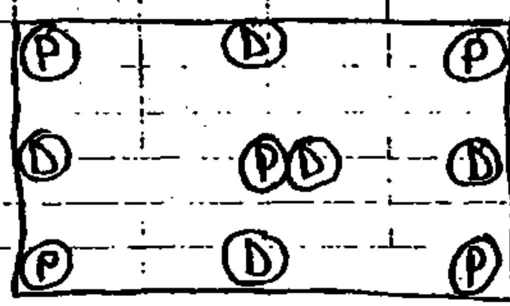
C:\Documents and Settings\libby.LIBBYQ2\Desktop\SQAPPmodformL.Fieldv3.doc
8/19/02

Project/Client ~~Libby Asbestos Site~~

Volpe Center EPA Region 8

~~[illegible]~~

③ Duplicate sample ~~prep~~ collection procedure does not appear to be correct. As samples are collected ~~now~~ extra volume is placed in the mixing bowl and homoginized then the portion in the bowl is placed in two diffrent bags and becomes the original sample and a duplicate. Auditor feel this is more of a split sample. Suggestion is to collect the duplicate same as co-located area samples where ~~sample~~ the parent sample (P) would be collected then the duplicate sample (D) would be collected from the same land use area ~~but~~ but not be collected adjacent to or with the parent sample but in a "random" fashion within the same area. See below figure.



P & D would be composite samples of the same

Project/Client Libby Asbestos Site

Volpe Center EPA Region 8

number of subsamples. ~~[illegible]~~

DW 8-22-02

[signature]

8-22-02

CDM

28 North Last Chance Gulch
Helena, Montana 59601
tel: 406 495-1414
fax: 406 495-1025

September 13, 2002

Jim Christiansen
United States Environmental Protection Agency
999 18th Street
Denver, CO 80202

Subject: Field Duplicate Sample Collection for the Libby Asbestos Site, Remedial Investigation (RI), Contaminant Screening Study (CSS)

Dear Mr. Christiansen:

Based on comments from Mary Goldade and an independent audit performed on the CSS during August of 2002, a change will be made in the collection procedure for field duplicate samples associated with the CSS. Duplicate samples previously collected as part of the CSS were collected by splitting a homogenized sample, and collected using the same sampling equipment. Beginning September 16, 2002, field duplicate samples will be collected using the following procedure:

A parent sample will be collected from up to 5 subsamples in a given land use area. The duplicate of this sample will be collected from the same number (i.e., 5) of randomly located subsamples in the same land use area. These samples will be independently collected with separate sampling equipment. The reason for this change is to better determine the variability of sample results in a given land use area. See Figure 1.

All previously (before September 16, 2002) duplicate samples will be referred to as field splits.

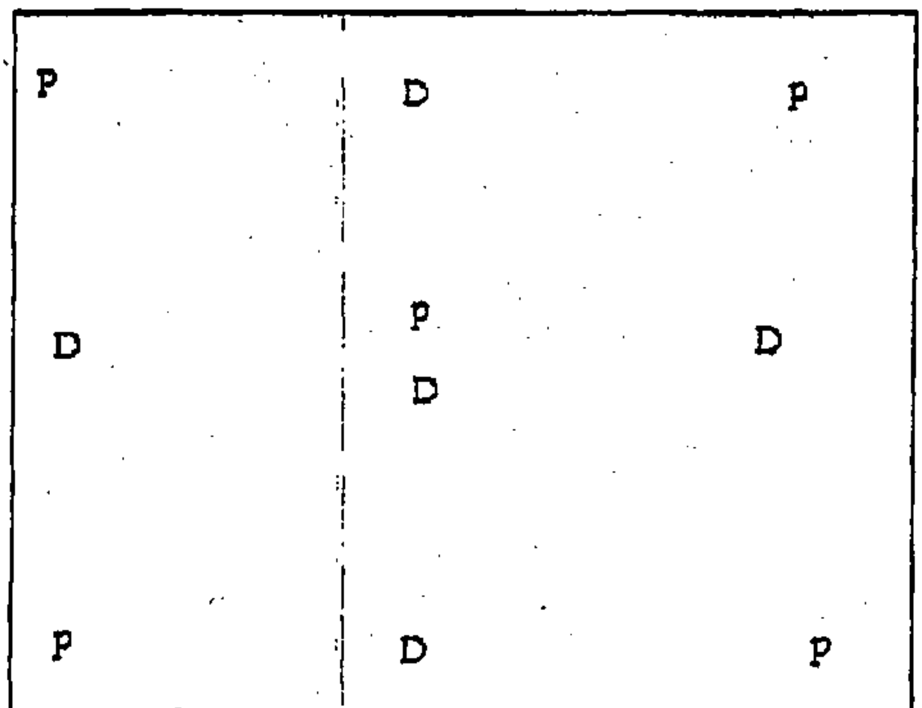
Very truly yours,

Dee Warren

Dee Warren
CSS Task Leader
Camp Dresser & McKee Inc.
cc: Mary Goldade (EPA)
Jeff Montera (CDM)
Angela Frandsen (CDM)

Document code

Figure 1 Field Duplicate Sample Collection from Land Use Areas



p = Subsample locations of parent sample
D = Subsample locations of duplicate sample

Appendix B
Protocol to stratify Bin B data
Into Bin B1 and Bin B2

Libby Database

Standard Report - PLM Business Rules

November 17, 2003

Reviewed & Confirmed to Libby Report code - 11/24/2004

Revisions in this document:
11/17/2003 – PLM-ve CharacteristicID of "MF" added

PLM-9002
AnalysisMethod ='PLM-9002'
ResultsQualifierID
ResultsValue
ResultsMineralClass ='TREM-ACTN', 'LA', 'CHRY', 'C'
(Results)CharacteristicID = 'TREM-ACTN', 'LA', 'CHRY', 'C'

PLM-600
AnalysisMethod ='PLM-600'
ResultsQualifierID
ResultsValue
ResultsMineralClass = (Same as PLM-9002)
(Results)CharacteristicID = (Same as PLM-9002)

PLM-Grav (PLM using Gravimetric)
AnalysisMethod ='PLM-Grav'
ResultsQualifierID
ResultsValue
ResultsMineralClass = 'LA', 'CHRY'
(Results)CharacteristicID ='LA', 'CHRY'

PLM-VE (PLM using Visual Estimate)
AnalysisMethod ='PLM-VE'
ResultsQualifierID
ResultsValue
ResultsBin
ResultsMineralClass = 'LA', 'C'
(Results)CharacteristicID = 'BIN', 'AF', 'MF'

NOTE: ResultsValue for Characteristic 'AF' are reported under the 'C%' heading.
ResultsValue for Characteristic 'MF' are reported under the 'LA%' heading.

PLM-PC (PLM using Point Count)
(PLM-PC is not currently being used: there is no PLM-PC data in the database)
AnalysisMethod ='PLM-PC'
ResultsValue
ResultsMineralClass = 'LA', 'C'
(Results)CharacteristicID = 'BIN', 'AF'

NOTE: ResultsValue for Characteristic 'BIN' is reported under the 'LA BIN' column.
ResultsValue for Characteristic 'AF' are reported under the 'LA%' or 'C%', based on Mineral Class.

Calculation of 'LA BIN'

PLM-9002 & PLM-600 (with AnalysisDate on or after 12/16/2002)
PLM-ve (all dates)

1.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= 'ND'	LA Bin = 'A'
2.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= 'TR'	LA Bin = 'B1'
3.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= '<'	
	AND ResultsValue = 1		LA Bin = 'B2'
4.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= Blank	
	AND ResultsValue > zero		LA Bin = 'C'

PLM-9002 & PLM-600 (with AnalysisDate prior to 12/16/2002)

1.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= 'ND'	LA Bin = 'A'
2.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= 'TR'	LA Bin = 'B'
3.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= '<'	
	AND ResultsValue = 1		LA Bin = 'B'
4.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= Blank	
	AND ResultsValue > zero		LA Bin = 'C'

PLM-Grav

1.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= 'ND'	LA Bin = 'A'
2.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= 'TR'	LA Bin = 'B1'
3.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= Blank	
	AND ResultsValue < or = 0.2		LA Bin = 'B1'
4.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= Blank	
	AND ResultsValue > 0.2 **AND** < 1.0		LA Bin = 'B2'
5.	ResultsQualifierID (MineralClass=LA or Trem-Actn)	= Blank	
	AND ResultsValue > or = 1.0		LA Bin = 'C'

NOTES:

- Characteristics of "LA" and "TREM-ACTN" are the same; both are reported under the "LA" Column on the Report.
- Characteristics of "C" and "CHRY" are the same; both are reported under the "C" Column on the Report.
- If AnalysisLabQCID is not equal to 'Not QA' or Blank, Result is not to be reported.